The Generation IV Roadmap Project

Roadmap Integration Team

Generation IV Roadmap Session
ANS Winter Meeting Reno, NV
November 13, 2001

People Involved in this Work

Roadmap Integration Team (RIT)

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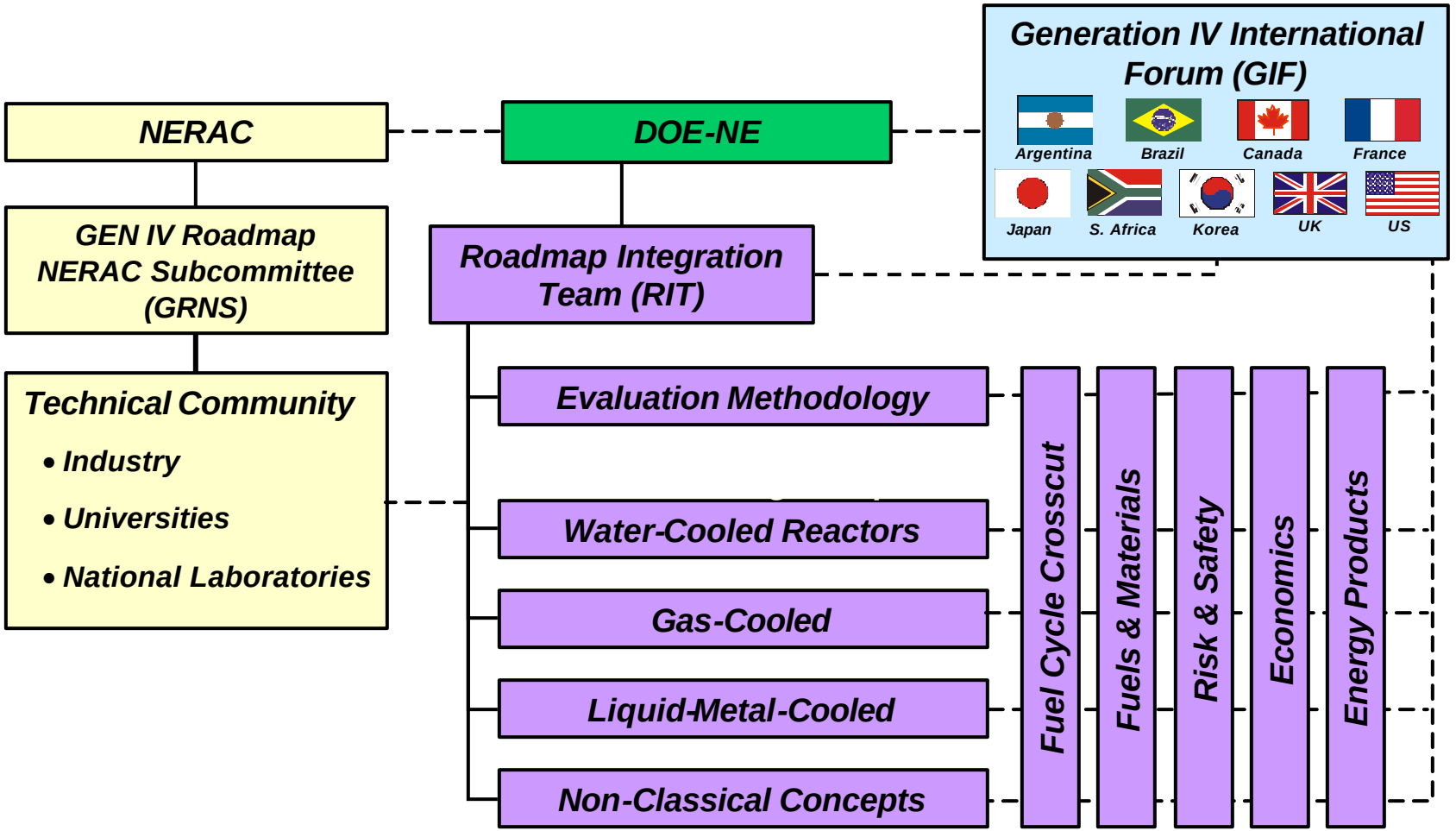
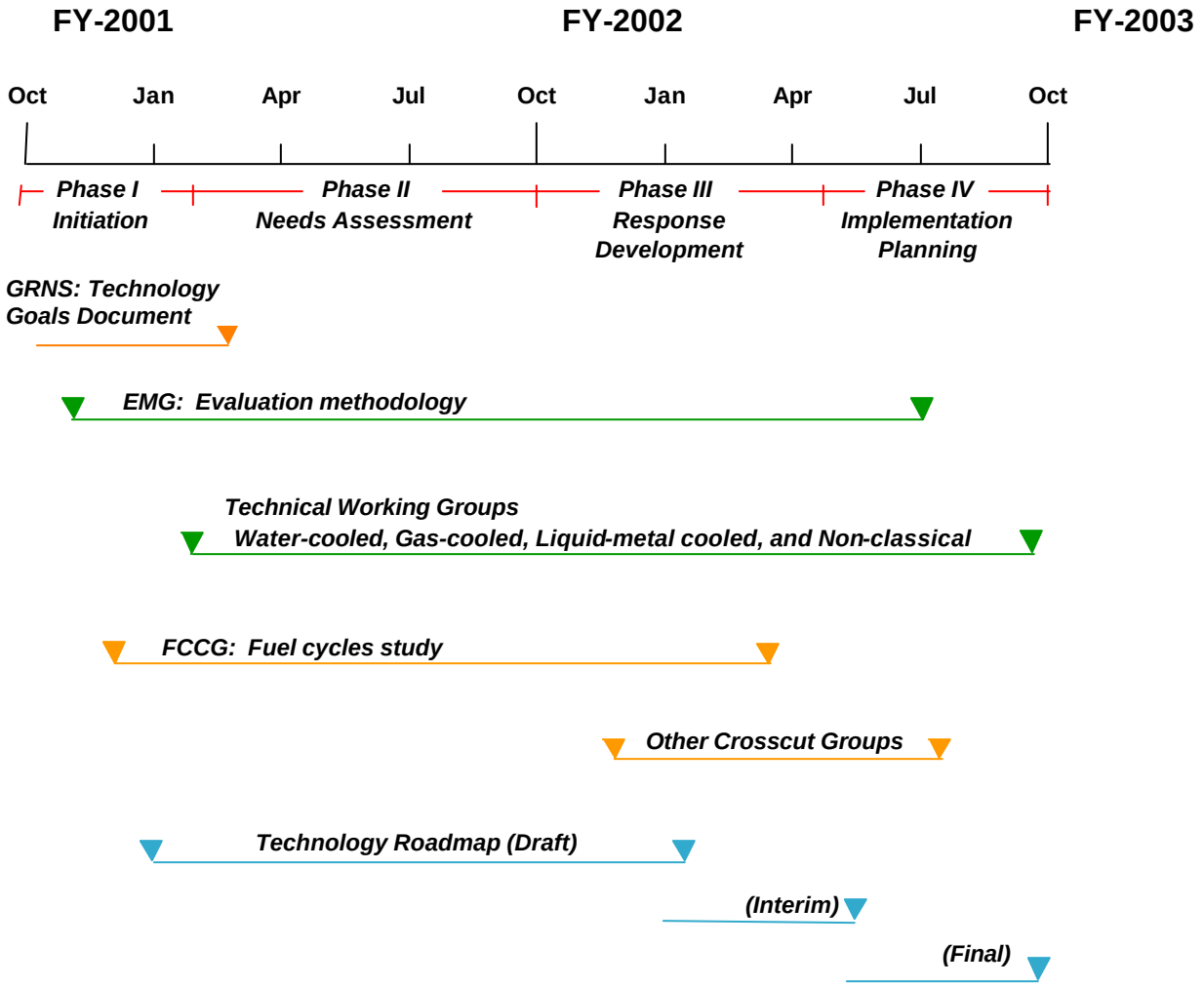
Overview of this Presentation

- *Roadmap Update: First Year*
  - *Organization*
  - *Roadmap Process*
  - *Current Status of Working Groups*
- *Roadmap Update: Second Year*
  - *Expectations*
  - *Issues*

Overall Roadmap Organization



Milestones on the Two-year Timeline



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Roadmap Process First Year

- *Technology Goals (GRNS, GIF)*
- *Fuel Cycle Evaluation (FCCG)*
- *Concept Description and Evaluation (TWGs)*
  - *Qualitative: Screening for Potential (EMG, TWGs)*
  - *Quantitative: Final Screening (EMG, TWGs)*

Key Definitions

Gen IV System:

An entire energy production system, including the nuclear fuel cycle front and back end, the reactor, the power conversion equipment and its connection to the distribution system for electricity, hydrogen, process heat or fresh water, and the infrastructure for manufacture and deployment of the plant.

Concept:

An example of a Gen IV system with enough detail to allow evaluation against the goals, but broad enough to allow for optional features and trades.

Concept Set:

A logical combination of concepts, similar enough to allow for common discussion and evaluation.

TWGs: Concept Sets

- *Water–Cooled*
  - *Integrated Primary System Reactors*
  - *Loop PWRs*
  - *Simplified BWRs*
  - *Pressure Tube Reactors*
  - *Super-critical Water Reactors*
  - *High-Conversion Cores*
  - *Pebble Fuel Reactor*
- *Gas–Cooled*
  - *Pebble Bed Reactors*
  - *Prismatic Modular Reactors*
  - *Very High Temperature Reactors*
  - *Fast Gas Reactors*

TWGs: Concept Sets (Cont.)

- *Liquid Metal–Cooled*
  - *Sodium–Cooled Reactors with MOX fuel*
  - *Sodium–Cooled Reactors with metal fuel*
  - *Lead or Lead/Bismuth Cooled Reactors*
  - *Sodium–Cooled with Novel Steam Generators*
- *Non-Classical*
  - *Liquid Core Reactors*
  - *Gas Core Reactors*
  - *Advanced High Temperature Reactor*
  - *Organic Cooled Reactors*
  - *Non-convectively Cooled Reactors*
  - *Direct Energy Conversion Reactors*

R&D Topics in Crosscut Groups

Fuel Cycle

- Fuel Cycles
- Mining
- Enrichment
- Fuel recycling
- Transmutation
- Waste disposal
- Proliferation resistance

Risk & Safety

- Static & transient analysis
- Design basis analysis
- Instrumentation and control
- Balance of plant
- Probabilisitic risk assessment
- Risk-based regulation
- Personnel safety

Economics

- Economic models
- Modularity
- Constructability
- Standardization
- Economics of operation
- Power conversion

Fuels & Materials

- Fuel, cladding, absorbers
- Fuel fabrication
- Fuel testing
- Spent-fuel behavior
- Structural materials
- Materials compatibility and testing

Energy Products

- Electricity
- Hydrogen production
- Desalination
- District & process heat
- Cogeneration

Roadmap Process
Second Year: Evaluate and Document

- *Evaluate the most viable concepts*
  - *Compare concept performance to goals*
  - *Final screening*
  - *Identify technology gaps*
  - *Capture needed R&D in R&D Scope Reports (March 2002)*
- *Assemble and integrate the Roadmap*
  - *Select the most promising concepts*
  - *Identify R&D needs in concept and crosscutting areas*
  - *Document a program plan with recommended phases*

Expectations

- *6-8 Concepts or sets enveloping most needs of GIF countries*
  - *Each one expected to attract some but not all countries*
  - *DOE interest is in the most innovative concepts*

- *R&D Plan designed for international collaboration*
  - *R&D tasks, task sequencing, and approximate task cost*
  - *Concept-specific R&D plan for each concept(set)*
  - *Crosscutting R&D serving more than one concept(set)*

Expectations (Cont.)

- *Symbiotic reactor combinations to be added*
  - *LWR + CANDU (DUPIC)*
  - *Thermal spectrum + fast spectrum (Na, Pb/Pb-Bi, Water, Gas)*
  - *Thermal spectrum + molten salt*

- *Innovative concepts promise significant advances toward goals*
  - *Safety: Gas (thermal), IPSRs*
  - *Sustainability: Na, Molten Salt, Fast-Spectrum Gas & Water*
  - *Economics: possibly Modular*

Summary

- ***Excellent international support***
- ***Technical Working Groups have assembled very comprehensive concept studies***
- ***Evaluation Methods Group has forged a methodology for the evaluations***
- ***Crosscut Groups are being integrated into the process of defining R&D paths***
- ***Concept selection and documentation of the Roadmap are the largest remaining challenges***